REMARKS

The Examiner is thanked for the thorough examination of the present application. The Office Action, however, has tentatively rejected all claims 1-26. Specifically, the Office Action has rejected claims 8-11, 21, 23, 25, and 26 under 35 U.S.C. § 102(b) as allegedly anticipated by U.S. patent 6,118,452 to Gannett. The remaining claims have been rejected under 35 U.S.C. § 103(a) as unpatentable over Gannett in view of one or more cited references.

Applicant has amended each independent claim in this application to clearly define features of embodiments of the present invention over the cited art. In view of the foregoing amendments and following remarks, Applicant requests that all rejections be reconsidered and withdrawn.

Rejections Under 35 U.S.C. § 112, second paragraph

The Office Action rejected claim 1 under 35 U.S.C. § 112, second paragraph. First, the Office Action alleged that that work "convention" is indefinite, and that a person skilled in the art would not know what a "conventional z-test" means. Although Applicant disagrees, to accommodate the Examiner's rejection, Applicant has deleted the term "conventional" from the claim. Also, Applicant made the cosmetic amendment of changing "matter" to "manner". A similar amendment has been made to similar language presented in claim 13 (even this that claim was not rejected on this basis).

The Office Action also rejected claim 1 on the basis that "the macropixel" lacked antecedent basis. Applicant has made an appropriate amendment to address and overcome this rejection.

Rejections Under 35 U.S.C. § 102(b)

The Office Action rejected claims 8-11, 21, 23, 25, and 26 under 35 U.S.C. § 102(b) as allegedly anticipated by Gannett. For at least the following reasons, Applicant respectfully requests reconsideration and withdrawal of the rejections.

At least one fundamental distinction exists between the cited Gannett reference and each independent claim. This distinction relates to the two-pass processing that is embodied in the present invention. As described in the summary section of the present application, the present invention is generally directed to a multi-pass rendering system and method. In one embodiment, in first pass of a graphics primitive data through a graphics pipeline, a compressed z-buffer is generated for the primitive. A primitive mask is also generated, which indicates whether all pixels of the primitive are hidden from view. In a second pass, graphics data for a given primitive is passed through the pipeline, only if the primitive mask for that primitive indicates that some portion of the primitive is visible. Thereafter, a two-level z-test is performed on that primitive. In the two-level z-test, a first level comparison is made on groups of pixels at a time, using the compressed z-buffer created in the first pass.

Significantly, in the claimed embodiments of the present invention, the two-pass rendering operation makes an operational determination on a per-primitive basis, wherein a primitive consists of a plurality of pixels. In contrast, Gannett describes a different sort of two-pass rendering operation, wherein an operation determination is made on a *per-pixel* basis. In this regard, Gannett describes:

> The graphics pipeline includes a visibility pretest module, located at a first operational position in the graphics pipeline, configured to determine whether a pixel will be visible or non-visible on the display screen.

(Abstract).

> The graphics pipeline includes a visibility pretest module, located at a first operational position in the graphics pipeline, configured to determine whether a pixel will be visible or non-visible on the display screen.

(Summary, Col. 3, lines 20-22)

Significantly, Applicant has amended each of the independent claims 8 and 21 to clarify that the rendering systems/methods of those embodiments operate on a per-primitive basis, wherein each primitive comprises a plurality of pixels. This patently distinguishes over Gannett, which teaches an operation on a per-pixel basis. In addition to this fundamental distinction, each of the independent claims 8 and 21 further define over Gannett for additional reasons, which are summarized below.

Turning first to independent claim 8, this claim has been amended above, and as amended claim 8 recites:

> 8. A method of rendering a plurality of graphic primitives comprising:
> *processing, within a graphic pipeline, only a limited set of graphic data for each primitive, wherein each primitive comprises a plurality of pixels*;
> determining, for each primitive, whether the primitive has at least one visible pixel;
> *processing, within the graphic pipeline, a full set of graphic data for only those primitives determined to have at least one visible pixel.*

(*Emphasis added.*) Applicant respectfully submits that claim 8 patently defines over the cited art for at least the reason that the cited art fails to disclose those features emphasized above.

Gannett fails to disclose the processing on a primitive of only a limited set of graphic data, then determining whether the primitive has at least one visible pixel, and thereafter processing a full set of graphic data for ONLY those PRIMITIVES determined to have at least one visible primitive. In this regard, the Office Action cited col. 13, lines 50-55 of Gannett as allegedly teaching the claimed operation of "processing, within a graphic pipeline, only a limited set of

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graphic data for each primitive, wherein each primitive comprises a plurality of pixels. In fact, this cited portion of Gannett actually states:

> The data which is received from the rasterization processing stage 114 is provided to the fragment operations processing stage 168 in the form of spans. A span consists of starting values, slopes, an X, Y and horizontal length of the pixels to render. As noted, this information constitutes a series of fragments.

Then, lines 55-59 continue by stating:

> Accordingly, a span consists of a predetermined number of fragments as defined herein. As is well-known in the art, one fragment corresponds to a single pixel and, according to the OpenGL specification, contains all the data necessary to render that pixel to the screen.

It is clear from even a cursory reading that this does not teach the claimed processing. Specifically, each fragment referenced in Gannett contains ALL the data necessary to render that pixel to the screen. Because the pretest module 202 of Gannett takes ALL necessary data to be rendered to the screen, it does not anticipate the first element of claim 1; namely, A LIMITED SET OF GRAPHIC DATA FOR EACH PRIMITIVE. For at least this additional reason, claim 8 patently defines over Gannett.

As independent claim 8 patently defines over Gannett, dependent claims 9-12 define over the cited art for at least the same reasons.

Turning next to independent claim 21, this claim has been amended above, and as amended claim 21 recites:

> 21. A graphics processor comprising:
> logic configured to limit the processing of graphic data for each of a plurality of primitives, in a first pass within a graphic pipeline, wherein the limited processing determines whether the primitive has at least one visible pixel, *wherein each primitive comprises a plurality of pixels;*
> *logic configured to render, in a second pass within the graphic pipeline, only the primitives determined in the first pass to have at least one visible pixel.*

(*Emphasis added.*) Applicant respectfully submits that claim 21 patently defines over the cited art for at least the reason that the cited art fails to disclose those features emphasized above.

Gannett fails to disclose logic to limit the processing of graph data *in a first pass within a graphic pipeline,* or logic configured to render, *in a second pass within the graphic pipeline,* only the primitives determined in the first pass to have at least one visible pixel. In this regard, Gannett does not teach or disclose such a two-pass pipeline processing. As noted above, Gannett discloses a "pretest module" that determines whether a pixel is visible or not. Gannett appears to disclose a system such that the processing is skipped for pixels that are determined not to be visible. However, Gannett does not appear to disclose a first level of processing through the pipeline (in a first pass), following by a second level of processing through the pipeline (in a second pass). For at least this additional reason, claim 21 patently defines over Gannett.

As independent claim 21 patently defines over Gannett, dependent claims 22-26 define over the cited art for at least the same reasons.

Rejections Under 35 U.S.C. § 103(a)

The Office Action rejected claims 1-3, 6, 7, and 13 under 35 U.S.C. § 103(a) as allegedly unpatentable over Gannett in view of U.S. patent 5,579,455 to Green. Applicant respectfully requests reconsideration and withdrawal of this rejection for at least the following reasons.

Independent claim 1 recites:

1. A multi-pass method of rendering a plurality of graphic primitives comprising:
in a first pass:
passing only a limited set of graphic data for each primitive through a graphic pipeline;
processing the limited set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels;

> *setting a visibility indicator, for each primitive, if any pixel of the primitive is determined to be visible;*
> in a second pass:
>> for each primitive, ***determining whether the associated visibility indicator for that primitive is set;***
>> ***discarding, without passing through the graphic pipeline, the primitives for which the associated visibility indicator is not set;***
>> ***passing a full set of graphic data for each primitive determined to have the associated visibility indictor set; and***
>> ***performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of an associated macropixel are visible.***

(*Emphasis added.*) Applicant respectfully submits that claim 1 patently defines over the cited art for at least the reason that the cited art fails to disclose those features emphasized above.

The Office Action alleges that Gannett discloses all claimed features, except that the z-buffer is a compressed z-buffer and performing a two-level z-test. In fact, Gannett fails to disclose a number of other significant claimed features. First, and as noted above, Gannett does not disclose a system that is structured or configured to perform a two-pass graphics processing approach. Claim 1, expressly defines steps associated with each of a first pass and a second pass (stating: "in a first pass ..." and "in a second pass ..."). This alone distinguishes over the application of Gannett.

Another basis for distinction relates to the visibility indicator. The Office Action cites element 308 (the visibility pretest controller) and col. 14, lines 18-22 of Gannett at allegedly disclosing the claimed features of:

> *in a second pass*
>> ***for each primitive, determining whether the associated visibility indicator for that primitive is set; discarding, without passing through the graphic pipeline, the primitives for which the associated visibility indicator is not set;***

> *passing a full set of graphic data for each primitive determined to have the associated visibility indictor set;*
> *...*

As noted above, there is no teaching in Gannett of such a two-pass approach. Consequently, there can be no teaching of the claimed steps occurring in the second pass (as expressly claimed). Furthermore, claim 1 defines the step of "determining" as taking place on a per-primitive basis. Gannett, however, provides no such disclosure. Instead, embodiments of Gannett operate on either a per-pixel basis or a per-fragment basis.

Further still, claim 1 defines "passing a full set of graphic data [down the graphic pipeline] for each primitive determined to have the associated visibility indicator set." The Office Action cites col. 13, line 60 through col. 14, line 9 as allegedly teaching this feature. Applicant disagrees. This portion of Gannett describes a two-span traversal of a certain graphic span. As is well known a span is only a portion of a primitive. Therefore, traversing a span twice, is NOT the same as processing a primitive by "passing a full set of graphic data for each primitive" through the graphic pipeline. For at least these additional and independent reasons, the rejection of claim 1 should be withdrawn.

As independent claim 1 patently defines over the cited art, dependent claims 2-7 define over the cited art for at least the same reasons.

Turning next to independent claim 13, the Office Action rejected claim 13 under 35 U.S.C. §103(a) as allegedly obvious over the combination of Gannett and Greene.

Claim 13 has been amended above, and as amended claim 13 recites:

> 13. A method of rendering a plurality of graphic primitives comprising:
> processing in a first pass, within a graphic pipeline, only a limited set of graphic data for each primitive, ***wherein each primitive comprises a plurality of pixels***;

processing the limited set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels;

in a second pass, within the graphic pipeline, performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of a macropixel are visible.

(*Emphasis added.*) Applicant respectfully submits that claim 13 patently defines over the cited art for at least the reason that the cited art fails to disclose those features emphasized above.

The Office Action applied Gannett as disclosing the basic first pass and second pass structure to the claimed method. The Office Action admitted, however, that Gannett does not disclose a compressed z-buffer. As Gannett does not disclose a compressed z-buffer, then it CANNOT properly disclose the structure of the claimed two-pass operation. In this regard, the compressed z-buffer is created during a first pass. As Gannett does not disclose a compressed z-buffer, it CANNOT create such a compressed z-buffer in a first pass. For at least this reason, the rejection of claim 13 should be withdrawn.

Turning next to independent claim 14, the Office Action rejected this claim under 35 U.S.C. § 103(a) as allegedly unpatentable over the combination of Gannett and U.S. patent 5,990,904 to Griffin. Applicant respectfully requests reconsideration and withdrawal of this rejection.

Claim 14 has been amended above, and as amended claim 14 recites:

14. A graphics processor comprising:
first-pass logic configured to deliver to a graphic pipeline, in a first pass, only a limited set of graphic data for each primitive, *wherein each primitive comprises a plurality of pixels;*
logic configured to process the limited set of graphic data for each primitive to create a compressed z-buffer;

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logic configured to determine, for each primitive, whether the primitive has at least one visible pixel;

second-pass logic configured to deliver to the graphic pipeline, in a second pass, a full set of graphic data for only those primitives determined to have at least one visible pixel, the second-pass logic further configured to inhibit the delivery of graphic data to the graphic pipeline for primitives not determined to have at least one visible pixel.

(*Emphasis added.*) Applicant respectfully submits that claim 14 patently defines over the cited art for at least the reason that the cited art fails to disclose those features emphasized above.

The Office Action alleges that Gannett discloses all claimed features, except that the z-buffer is a compressed z-buffer. In fact, Gannett fails to disclose a number of other significant claimed features. First, and as noted above, Gannett does not disclose a system that is structured or configured to perform a two-pass graphics processing approach. Claim 14 expressly recites "first-pass logic..." and "second-pass logic..." No such comparable teachings are disclose in Gannett.

As noted above, there is no teaching in Gannett of such a two-pass structure. Furthermore, claim 14 defines the logic configured to determine, *for each primitive*, whether the primitive has at least one visible pixel of "determining" as taking place on a per-primitive basis. Gannett, however, provides no such disclosure. Instead, embodiments of Gannett operate on either a per-pixel basis or a per-fragment basis. For at least this additional reason, claim 14 patently defines over the cited art.

As independent claim 14 patently defines over the cited art, dependent claims 15-20 define over the cited art for at least the same reasons.

Independent basis for patentability of Claims

As a separate and independent basis for the patentability of claims 1-7, 12-20, 22 and 24, Applicant respectfully traverses the rejections as failing to identify a proper basis for combining the cited references. The Office Action combined various selected teachings from Gannett, Greene, and Griffin to reject these claims. For example, the Office Action rejected claims 1-3, 6, 7, and 13 as unpatentable over the combination of Gannett and Greene. In combining these references, the Office Action stated only that the combination would have been obvious "because Greene suggests the advantage of rejecting hidden geometry very quickly and having an algorithm which is much faster than traditional ray-casting or z-buffering." (Office Action, page 7). In rejecting claims 4 and 5, the Office Action further combined Duluk (U.S. patent 6,476,807) alleging that the combination would have been obvious "because Duluk suggests that this is what is needed in order to have an accurate z value." (Office Action, p. 10). In combining Griffin with Gannett to reject claims 12, 14-20, 22, and 24, the Office Action alleged that the combination would have been obvious "because Griffin suggest the advantage of considerably reducing the amount of data required, allowing practical implementation of a much more sophisticated anti-aliasing algorithm." (Office Action, p. 12). These motivations are improper or deficient in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

> "The consistent criteria for determination of obviousness is whether the prior art
> would have suggested to one of ordinary skill in the art that this [invention] should
> be carried out and would have a reasonable likelihood of success, viewed in light of
> the prior art. ..." Both the suggestion and the expectation of success must be founded

in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(*Emphasis added.*) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a method and apparatus for rendering graphics, as claimed by the Applicant.

When an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the "absence of such a suggestion to combine is dispositive in an obviousness determination").

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembiczak, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be "clear and particular." Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 ("The absence of such a suggestion to combine is dispositive in an obviousness determination.").

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000).

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, those rejections should be withdrawn. Indeed, the broad proclamations made by the Office Action (relating to such general or nebulous things such as improved efficiency) could be used to combine virtually any two or more references (with improper hindsight) in order to support a rejection.
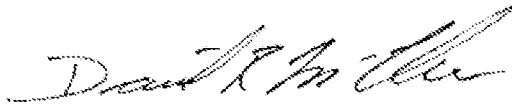
CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance.

Should the Examiner have any questions regarding this response, the Examiner is invited to telephone the undersigned attorney at (770) 933-9500.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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